FACTS
ABOUT THE SAVANNAH RIVER SITE

December 2005

# Waste Management

At the Savannah River Site (SRS), waste was generated as a result of the production and manufacturing of plutonium, tritium and other nuclear materials required to support our national defense and NASA space missions. SRS manages liquid radioactive waste (as high-level or low-level waste), hazardous waste, mixed waste, transuranic waste, and sanitary (non-radioactive, non-hazardous) waste.

## Liquid radioactive waste

After fuel and targets were fabricated, assembled and irradiated in nuclear reactors, the resulting spent fuel and targets were taken to the chemical separations facilities. There, the desired nuclear materials were chemically separated, leaving the unusable byproducts as intensely radioactive waste, in both solid and liquid forms.

In liquid storage tanks, the insoluble solids settle and accumulate on the bottom of the tanks. This is referred to as “sludge.” Liquid above the sludge is concentrated by evaporation to reduce its volume. The concentration process produces a precipitated solid called “salt cake” and the remaining concentrated liquid is commonly referred to as supernate or “liquor.”

All of the liquid radioactive waste produced at SRS to date is stored in 49 tanks on site. For conservative purposes, and with the exception of one tank, this waste is managed as high-level waste. Approximately 100 million gallons of high-level waste have been concentrated by evaporation to a present volume of about 36 million gallons.

SRS waste tanks have provided more than 40 years of safe storage for this nuclear waste. These tanks include four designs, all consisting of a steel tank within a concrete vault.

- Types I and II, the oldest tanks, have 5-foot-high secondary steel containment pans within a concrete vault and forced cooling systems. Type I tanks are 75 feet in diameter and hold 750,000 gallons. Type II tanks are 85 feet in diameter and hold 1.03 million gallons. Some of these tanks have developed small hairline cracks that leaked salt solution into secondary pans below the tanks. The cracks were induced by high nitrate concentration in the waste solutions and residual stresses near weld sites.

- Tank 16, a Type II tank, is the only tank to have had a release of waste from the secondary pan. The leak, which occurred in 1960, was from the primary tank into the secondary pan and then through a concrete vault joint into the ground. The tank was removed from service, cleaned, and awaits decommissioning. The location where the waste contacted the soil continues to be monitored to ensure that it has not migrated to other areas.

- The Type III tanks hold 1.3 million gallons and are 33 feet high and 85 feet in diameter. The inner (primary) tank that actually holds the waste is shaped like a doughnut around a central concrete column that supports the roof. A secondary containment tank completely surrounds the primary. The secondary tank is surrounded by a 2- to 4-foot thick concrete vault. As a fourth independent containment for the waste, a

minimum 10-foot layer of specially selected, impermeable clay is placed around the tank. No cracks or leak sites have occurred in any of the Type III tanks.

- Type IV tanks have a single wall and do not have a forced cooling water system. Type IV tanks are designed for waste storage that does not require auxiliary cooling. This tank type is basically a steel tank within a prestressed concrete vault in the form of a vertical cylinder with a domed roof. Each tank holds 1.3 million gallons and is 85 feet in diameter and 34 feet high.

Plans call for removing the waste from all of the tanks to the maximum extent practical for processing in existing and new facilities for final disposal.

- The sludge that remains in the waste tanks (which contains approximately half of the radioactivity but most of the long-life radioactivity), along with the radioactive cesium, strontium, and any actinides separated from the salt solution, will be transferred to the site's Defense Waste Processing Facility for immobilization within borosilicate glass. The Defense Waste Processing Facility began radioactive operations on March 12, 1996, and as of late-2005 has produced more than 2,000 canisters of vitrified high-level waste.

- Starting in about 2012, the salt waste will be processed in a planned Salt Waste Processing Facility (SWPF) to remove cesium, strontium, and actinides. The decontaminated salt solution will then be sent to the existing Saltstone Facility, where it will be mixed with cement-like materials to produce a solid "saltstone" low level waste form. The highly radioactive cesium, strontium, and actinides will be sent to the DWPF for mixing with the sludge and vitrified. Before SWPF startup in about 2009, a limited quantity of salt waste will be processed through modified and new small-scale facilities to remove some of the radioactivity in the salt waste. This interim processing is planned to start in 2006 to ensure adequate tank space is maintained to continue operation of DWPF and to provide feed tank capacity for SWPF when it starts up.

## Liquid low-level waste

Liquid low-level waste is a by-product of the separations process and tank farm operations. This waste is treated in the Effluent Treatment Project (ETP). This facility treats the liquid waste for discharge to a National Pollutant Discharge Elimination System permitted outfall, effectively capturing all chemical and radioactive contaminants except tritium. The state-of-the-art process includes: pH adjustment, submicron filtration, organic removal, reverse osmosis and ion exchange. ETP replaced the seepage basins that were used until November 1988.

## Sanitary waste

Sanitary waste or municipal solid waste is solid waste that is neither radioactive nor hazardous. Sanitary waste consists of materials that would be received by a municipal sanitary landfill (office waste, food, garbage, refuse and other solid wastes that are similar to those generated by most households) and industrial waste (construction debris, scrap metals, wood waste, etc).

## Solid low-level waste

The site's solid low-level wastes include such items as contaminated protective clothing, tools and equipment that have become contaminated with small amounts of radioactive material. Prior to 1994, SRS disposed of waste in trenched burial grounds, without some of the engineered featured of current disposal systems. In 1994, SRS opened engineered concrete vaults for the permanent disposal of solid low-level waste. Low-level waste that is very low in radioactivity may also be disposed in trenches. Long-term radiological performance assessment document that wastes meet the Department's low-level waste disposal performance requirements. Waste acceptance limits are derived to ensure performance criteria such as drinking water standards are adhered to.

Two types of vaults are used, one for low-activity waste (waste radiating less than 200 mrem/hour) and one for intermediate-activity waste (waste radiating greater than 200 mrem/hour). The concrete used in both was specially formulated. Its composition is designed to mitigate cracking, extending the vault life.

Some trenches opened in 1994. These are called slit trenches because they are long and narrow, measuring 20 feet wide and 600 feet long. These are used primarily for disposal of soil from potentially contaminated areas containing no measurable radioactivity and construction debris from deactivation and decommissioning activities.

In 2001, SRS began disposal of low-level waste with extremely low radioactive content in Engineered Trenches. This "drive-in" trench, located inside E-Area, is designed to extend the useful life of the existing Low Activity Waste Vaults and allow shallow land burial of selected low-level waste. The Engineered Trench measures 600 feet in length by 150 feet in width. It is equipped with a concrete sump and pump system (including sample station) to manage anticipated rainfall. The trench is also equipped with a vadose zone monitoring system installed around the perimeter.

## Transuranic waste

Waste that contains transuranic nuclides (radioactive elements with an atomic number greater than uranium [92] that have half-lives greater than 20 years and are in concentrations granter than 100nCi per gram) is prepared for shipment and stored at SRS while awaiting shipment to the Department of Energy Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. The shipments of waste from SRS to WIPP started in 2001, and continue.

## Hazardous waste and mixed waste

Hazardous wastes and mixed (containing both hazardous and radioactive components) wastes are stored in South Carolina permitted facilities on site until shipped offsite for treatment and disposal.

## Waste minimization program

SRS has an active waste minimization program to reduce volume and/or avoid production of all waste types generated at the site. Efforts to reduce or eliminate waste before it is generated include process modifications, use of alternative process materials, recycling and reuse. Efforts to reduce waste after it has been generated include segregation of non-radioactive and non-toxic materials.